



Timing of massive 'Fleuve Manche' discharges over the last 350 kyr: insights into the European ice-sheet oscillations and the European drainage network from MIS 10 to 2

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Continuous high-resolution mass accumulation rates (MAR) and X-ray fluorescence (XRF) measurements from marine sediment records in the Bay of Biscay (NE Atlantic) have allowed the determination of the timing and the amplitude of the 'Fleuve Manche' (Channel River) discharges during glacial stages MIS 10, MIS 8, MIS 6 and MIS 4-2. These results have yielded detailed insight into the Middle and Late Pleistocene glaciations in Europe and the drainage network of the western and central European rivers over the last 350 kyr. This study provides clear evidence that the 'Fleuve Manche' connected the southern North Sea basin with the Bay of Biscay during each glacial period and reveals that 'Fleuve Manche' activity during the glaciations MIS 10 and MIS 8 was significantly less than during MIS 6 and MIS 2. We correlate the significant 'Fleuve Manche' activity, detected during MIS 6 and MIS 2, with the extensive Saalian (Drenthe Substage) and the Weichselian glaciations, respectively, confirming that the major Elsterian glaciation precedes the glacial MIS 10. In detail, massive 'Fleuve Manche' discharges occurred at ca 155 ka (mid-MIS 6) and during Termination I, while no significant discharges are found during Termination II. It is assumed that a substantial retreat of the European ice sheet at ca 155 kyr, followed by the formation of ice-free conditions between the British Isles and Scandinavia until Termination II, allowed meltwater to flow northwards through the North Sea basin during the second part of the MIS 6. We assume that this glacial pattern corresponds to the Warthe Substage glacial maximum, therefore indicating that the data presented here equates to the Drenthe and the Warthe glacial advances at ca 175-160 ka and ca 150-140 ka, respectively. Finally, the correlation of our records with ODP site 980 reveals that massive 'Fleuve Manche' discharges, related to partial or complete melting of the European ice masses, were synchronous with strong decreases in both the rate of deep-water formation and the strength of the Atlantic thermohaline circulation. 'Fleuve Manche' discharges over the last 350 kyr probably participated, with other meltwater sources, in the collapse of the thermohaline circulation by freshening the northern Atlantic surface water.

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